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American Statistical Association

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1950 Report of the Committee on Institutional Memberships

The Committee on Institutional Memberships, established at the annual meetings in December, 1949, has initiated a selective campaign to gain support for ASA activities from business organizations. Early results are encouraging, since the number of institutional members contributing $100 or more annually has risen from five to fourteen during the past year, with a net gain in ASA funds of over $1,000.

It is obvious that persistent effort will be necessary to expand institutional memberships in the business community, because the activities of the ASA of specific interest to business are not well known, and the ASA is competing with innumerable other organizations asking for financial support. Nevertheless, there is good reason to anticipate substantial increases in institutional memberships as the activities of the new section on Business and Economic Statistics grow.

Establishment of the Institutional Membership Committee was the direct result of: (1) the financial problems of the ASA, and (2) the creation of the new ASA section on Business and Economic Statistics. A number of persons associated with business firms evidenced willingness to contribute financial as well as other direct support to the new section, and it is from this nucleus that the institutional memberships are being expanded.

Originally an effort was made to interest all local ASA chapters in supporting the drive for institutional memberships by appointing a chairman for local solicitation. Outside of a few of the largest chapters, almost no response was forthcoming. This was in spite of action by the ASA Board to provide incentive to local chapters by authorizing $25 rebate annually to treasuries of chapters obtaining institutional memberships.

The institutional membership campaign is now keyed to a master list of prospects, each to be solicited upon a personal basis by a member of the committee or his delegated representative. To avoid possible duplicate solicitations, the chairman maintains a clearance file for each name on the master list. All ASA members are strongly urged to assist in this important work by pointing out the value of ASA activities to persons associated with institutions which might become ASA members. Committee members will be glad to help in the solicitation of any prospect. The chairman can quickly inform anyone whether a prospect is on the master list scheduled for solicitation and give all possible help if the prospect is not now listed. The master list is only a control device and should not be allowed to interfere with any potentially successful solicitations.

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NEWS

U.N. Far Eastern Statistical Conference—Federal Government positions available—Summer sessions in statistics—U.S. statistical projects

U. N. Far Eastern Conference

The United Nations inaugurated regional conferences of statisticians with one for the Far East which met in Rangoon, Burma, from Jan. 22 to Feb. 3. It was called pursuant to a resolution of the Economic Commission for Asia and the Far East. Delegates attended from sixteen Far Eastern countries. Balance of payments statistics and international trade statistics were the major topics discussed. The session adopted a resolution recommending that a similar conference be held in 1952 to consider other branches of statistics having direct relation to the most pressing economic problems in the countries of the region.

The United Nations technical assistance administration contributed to the expenses of some of the experts attending the conference. It did so, it announced, "in the belief that sound information concerning the foreign exchange position of a country, and sound techniques for improving its foreign exchange position, are important preliminary steps in accumulating or securing capital for economic development projects."

Econometric Society elects new Fellows

The Council of the Econometric Society approved the election of the following eight new Fellows: Johan Akerman, T. W. Anderson, Jr., Dorothy S. Brady, R. Maurice Frechet, Nicholas Georgescu-Roegen, Alvin H. Hansen, Oskar Morgenstern, and Jerzy Neyman.

The CARE-UNESCO Book Fund

The CARE-UNESCO Book Fund is a program which supplies important new technical books to universities, libraries and medical and scientific centers overseas. It was established with the cooperation of the Library of Congress, the American Library Association, and private scientific groups.

The Fund's bibliography is based on the requests of professional people abroad and covers the field of statistics as well as many other social and physical sciences. The program operates in Austria, Belgium, Burma, Ceylon, Finland, France (and colonies), Greece, India, Italy, Germany (American, French and British Zones as well as Berlin), Japan, Malta, The Netherlands, Norway, Okinawa, Pakistan, The Philippines, Thailand, Trans-Jordan, United Kingdom and Yugoslavia.

By making a general contribution you can share directly in this important program of supplying American scientific knowledge to professionals abroad who are unable to buy technical books for themselves. Individuals and institutions giving $10 or more, may request books for a specific institution or indicate their choice of country, type of institution and category of books.

Further information may be secured by writing to the CARE-UNESCO Book Fund, 20 Broad Street, New York 5, New York, or to your local CARE office.

Columbia University's Department of Industrial Engineering plans Conference on Industrial Research June 11-15, 1951

The program of the Second Annual Conference on Industrial Research will emphasize personnel and communications in industrial research. Attendance will be limited to sixty persons and applications will be accepted in the order of their receipt. Communications concerning the Conference should be sent to the Department of Industrial Engineering, Columbia University, New York, N. Y.

Federal Government Examinations for Positions in Washington and Vicinity

The United States Civil Service Commission has announced an examination to fill the positions of Business Analyst, Commodity-Industry Analyst, and Industrial Specialist paying from $3,450 to $6,400 a year, in various Federal agencies in Washington, D. C. and vicinity.

No written test is required for these positions. To qualify, applicants must have had from 3½ to 6 years (depending on the grade level for which they apply) of appropriate experience with specialization in one or more industries, commodities, or business activities.

Pertinent education may be substituted for the experience required for positions paying up to $4,600 a year.

The maximum age limit of 62 years will be waived for persons entitled to veteran preference.

Full information concerning the requirements to be met is given in civil service Announcement No. 259 which may be consulted at most first- or second-class post offices. Application forms may also be obtained from these offices, from civil service regional offices, or from the U. S. Civil Service Commission, Washington 25, D. C. Applications will be accepted by the Commission's Washington office until further notice.

Examination for Mathematical, Analytical and Survey Statistician

The Civil Service Commission has announced that applications will be accepted for mathematical, analytical and survey statisticians at Grades from $3,825 to $5,400 for positions in Washington, District of Columbia, Alexandria, Virginia, Arlington County, Virginia and Prince Georges and Montgomery Counties, Maryland. Anyone not wishing to work in these areas should not apply. Requirements for the lowest position include a minimum of 5 years statistical research experience, of which at least one year must have been devoted to mathematical statistical research including the development and uses of statistical research techniques requiring a comprehensive knowledg of fundamental statistical theory. In many instances, study in accredited institutions will be substituted for working experience. No written tests are required. Applicants will be given a rate of eligible or ineligible on the basis of their training and experience and must be citizens of the United States.

To apply for this examination, fill out card form 5001-ABC and Form No. 57 and send them to the United States Civil Service Commission, Washington 25, D. C. Applications will be accepted until further notice.

The forms to be filled out may be obtained from United States Civil Service Regional Offices. In cities where there are no regional offices, any first- or second-class post office will supply them.

N.I.C.B. Study of Military Inspection

The National Industrial Conference Board, at the request of its advisory council on industrial mobilization has made a study of World War II experience with military inspection. Three hundred companies were surveyed, as well as armed services inspection personnel. Among the major criticisms by World War II contractors was the following: "Too much 100 per cent inspection; too little spot checking and use of statistical quality control methods." Among the major criticisms by armed services inspection personnel was the following: "Limited use by manufacturers, particularly small and medium-sized companies, of modern management techniques and statistical quality control."

Basic Statistics for Emergency Programs

(For the past three years the staffs of the Joint Committee on the Economic Report, the Division of Statistical Standards in the Bureau of the Budget, and the Council of Economic Advisors have collaborated on statements of "Statistical Gaps," calling attention to areas where more complete statistical measures were needed as a basis for the determination of economic policy, and reporting on progress made in filling these gaps. This year first consideration has been given to how the government's basic statistical programs are meeting the new and specialized requirements of the emergency period. Excerpts from the report, which is included as an appendix in the Joint Committee's Report on the January 1951 Economic Report of the President, are reprinted below.)

In developing the nation's defense program and in carrying out emergency responsibilities, prompt and accurate facts are needed on what is happening to production, consumption, imports and exports of critical materials; food supplies; wage and price levels; deployment of manpower resources; the distribution of savings and expenditures; capital expansion; credit controls; business inventories; the volume of goods moving to the civilian population through retail outlets; and other critical areas of the economy. Fortunately in most of these areas we already have a program capable of adaptation to meet emergency needs. Since the end of World War II, emphasis in reorganizing the Government's statistical services has been placed on building a basic system which could meet current needs for prompt and accurate economic measures. These basic measures of employment, production and other economic factors are relied on in the defense period, just as in other periods, to keep track of the progress of the economy. In addition they are capable of ready adaptation to meet special emergency needs for statistical data. To the extent that we have succeeded in building this basic framework, emergency needs are now being met by use of existing programs, with adaptation or expansion where necessary.

Maximum utilization of the facilities, resources and special skills in the regular agencies to meet emergency needs is desirable for many reasons. Use of regular reporting channels makes it possible to collect the information needed at least cost to the Government and least burden to the public. It avoids the necessity for creating costly and duplicative statistical facilities in the emergency agencies. Furthermore, continuity in the collection and analysis of statistical data is essential if inconsistencies and gaps in the periods covered are to be avoided. From a long-term point of view, maintenance of basic statistical series on a regular basis is essential so that the series may continue to serve their permanent functions after the emergency period is over.

How the existing series and other resources of the Government are being utilized to meet the needs for data in the present emergency may best be shown by a few examples. The National Production Authority must have data on the production and consumption of critical materials to establish and administer priorities and allocations programs. These data are now being obtained promptly and economically, primarily through utilization. with adaptation where necessary, of the industrial statistics program of the Bureau of the Census. Special tabulations have been made for NPA of data received in the Census Bureau's 1947 Census of Manufactures; more current needs are being met through the 1949 and 1950 annual surveys of manufactures and the current industrial statistics reports. The new NPA quarterly report of plant operations is being collected with the greatest possible speed and economy by utilizing the Census Bureau's facilities for large-scale collection and processing of statistical data. By obtaining the statistical data necessary to its operations through maximum use of the Census Bureau, and of other agencies in specialized areas, the NPA finds itself with respect to essential statistical intelligence many months and millions of dollars ahead of the WPB at a comparable period in the World War II mobilization.

In much the same way, statistical needs of the Defense Minerals Administration, the Solid Fuels Administration for Defense and the Petroleum Administration for Defense are being met primarily through existing facilities in the Bureau of Mines. Regular Bureau of Mines reports on production and consumption of minerals and fuels are adapted where necessary to obtain additional detail or to be collected and tabulated at more frequent intervals.

Data on business financial operations, essential to the Economic Stabilization Agency, can most efficiently be supplied through expansion of the joint financial statistics program of the Federal Trade Commission and the Securities and Exchange Commission. In this case the immediate change needed will be extension of the quarterly reports to include a sample of nonmanufacturing concerns in addition to the present reports from manufacturing corporations.

In the field of wage statistics, the Bureau of Labor Statistics during the past two years has developed a pattern for community wage surveys to meet important continuing needs of many agencies for local wage data. Regular surveys of this type are included in the Bureau's proposed program for 1952, and will be immediately useable to meet the needs for statistical data in determining wage policies and in administering wage controls. Here the adaptation required will be primarily expansion of the program to include additional cities where local information may be needed in administering the wage stabilization program.

In the field of manpower statistics, information on changes in the size and composition of the labor force is kept up to date as the mobilization proceeds by means of the Census Bureau's current population statistics program. Needs for current employment data in particular industries and areas are being met by supplementing the coordinated employment statistics program conducted by the Bureau of Labor Statistics in cooperation with the Bureau of Employment Security and the State employment security agencies. Expansion and redirection of the reports to the Bureau of Employment Security in local employment service office operations will provide additional detail needed for manpower mobilization activities.

Many other examples could be cited: the statistical reports of the Bureau of Agricultural Economics are providing much of the factual information necessary to the Department of Agriculture in executing its responsibilities for war food programs. The statistical series and analytic work on prices now conducted by the Bureau of Labor Statistics and the Department of Agriculture will be fully utilized by the Office of Price Stabilization; as price control actions are taken, important adaptations will need to be made in these existing price series. The 17th Decennial Census is providing a vast inventory of the resources of the nation in terms of the population and its labor force, housing and farms. The current information collected by the Bureau of Labor Statistics on dwelling units started in the United States and on the number, characteristics, and selling price or rent of new units in selected metropolitan areas, will be used to compare actual volume with the announced Government goal (850,000 units for 1951), to measure effects of housing credit restrictions and materials allocations and controls, and to evaluate the adequacy of housing for defense workers.

In considering the relation of emergency programs to continuing needs for statistical information on the national economy, one other factor should be borne in mind. The emergency programs also obtain directly, as a by-product of administrative operations, a considerable quantity of detailed information which is a potentially valuable source for statistical compilations. Thus the application forms received directly by the emergency agencies in administering allocation or credit control programs, for instance, may contain information valuable for purposes of economic analysis. Administrative records such as these should be preserved for later analysis, and are likely to prove very useful in studies of the utilization of productive capacity, capital expansion, economic concentration, and other topics on which available data are inadequate.

In brief, we may summarize by stating that the requirements for statistical data will be greatly increased by the

administration of the economic controls necessary during the defense emergency. This information can be obtained most rapidly, economically and efficiently by utilizing the specialized skills and facilities already available within the Government. In order for these arrangements to be most effective, it is important that the Government's basic statistical services be maintained and strengthened.

Post-Enumeration Survey of the 17th Decennial Census

The Bureau of the Census is conducting a Post-Enumeration Survey to estimate the extent of error in the 1950 Census data. The survey involves reinterviews obtained from a sample of approximately 22,000 households who were asked more detailed questions by carefully selected and trained interviewers. The Post-Enumeration Survey was designed to check particularly on the coverage of the Census (extent of over- and under-enumeration). However, for cases which were properly enumerated in the Census, a check was also made on the accuracy of some of the Census items. The survey results will also be used to check the quality of data obtained in those areas where experimental procedures were used in taking the Census.

Special efforts were made in the Post-Enumeration Survey to obtain a high level of accuracy. For example, the instructions called for obtaining the information only from the respondent who appeared to be best qualified to answer, even if interviewing this person entailed several call-backs. Another feature of the Post-Enumeration Survey is the collection of data on 1949 income for some of the families covered by the Federal Reserve Board's Survey of Consumer Finances. The data collected by the two surveys will be compared and the results used to improve techniques in future studies of income.

As part of the Post-Enumeration Survey, the information collected is being matched against independent records for the persons included in the survey: birth certificates, 1920 Census reports, the files of the Veterans Administration (for veteran status), the files of the Immigration and Naturalization Service (for citizenship status), and the Bureau of Old-Age and Survivors Insurance files (to compare employees' reports on industry and wages received with employers' reports on the same items). The record-check samples vary in size from about 6,000 cases to about 20,000 cases.

ELI S. MARKS, Bureau of the Census

BLS Fact Book on Manpower

A *Fact Book on Manpower* was published early in February by the Bureau of Labor Statistics to provide in convenient form the data needed for evaluating manpower trends in the emergency period. The volume presents data previously available from a number of different sources, including publications of the Bureau of the Census, the Bureau of Employment Security, the Bureau of Labor Statistics and other agencies. Tables, charts and text material are presented on the following topics: population, labor force, women workers, employment and hours, occupations, education and training, mobility of labor and military manpower.

The *Fact Book* was prepared in response to numerous requests for assembly of the most pertinent summary data on manpower. The original printing of 10,000 copies was exhausted within a month, and a second printing ordered. The Bureau of Labor Statistics expects to revise the volume periodically to incorporate results of current studies undertaken on various aspects of labor problems. Copies of the *Fact Book* are available, without charge, on request to the Bureau of Labor Statistics, Department of Labor, Washington 25, D. C.

HAROLD WOOL, Bureau of Labor Statistics

CHICAGO PLACEMENT SERVICE

The material reproduced below represents items which have been developed by the Personnel Placement Committee of the Chicago chapter under the chairmanship and editorship of Mr. De Ver Sholes. It is interesting that in Chicago the Placement Service is offered to everyone without any strings attached. Favorable experience with this service has led a number of statisticians to join the local chapters. It has also helped and encouraged trained statisticians to stay in the field instead of securing employment in other fields.

Placement Committee Outline of Systematic Procedure for Seeking Employment

Select companies which you believe will employ statisticians. Usually these will be the larger business firms in the community engaged in manufacturing, retailing, wholesaling, and the firms engaged chiefly in research activities, such as market analysis firms, management engineering firms, advertising agencies, labor relations consultants, etc. (In most cases this type of approach will not be effective in contacting governmental agencies. For those organizations, secure the publication from the Placement Committee on seeking a position with government offices.)

To aid you in the selection of the firms you wish to approach, use such sources as *Moody's Investment Manual; Standard Corporation Record; Poor's Register of Directors and Executives; Certified List of Foreign and Domestic Corporations*, published by the Secretary of State of Illinois; chamber of commerce industrial lists (such as the list of large manufacturers published by the Chicago Association of Commerce and Industry); trade association lists, business magazines, business sections of the daily papers; teachers; and businessmen.

When you elect the firms, try to obtain the name of an individual in each organization with whom you can make contact. This individual should be one of the officers of the firm, preferably the one in charge of statistical work. Lacking the name of an officer, direct your inquiry to the "Personnel Director." It is usually better to have your letter or original inquiry come to an officer who is above the level to which you will apply directly and have him refer it down to the person whom you should interview.

An interview should be arranged with someone in the organization before approaching the company direct. This may be done either by phone or by letter. The more formal approach of the letter usually gives a better impression. However, in many instances typing becomes a burden both in time and effort, in which case skilled telephone inquiries may be almost as effective.

A personal data sheet (see example attached) should be sent with every letter, or should be presented at the interview. Here again, typing an original data sheet may become too time-consuming, in which case it is recommended that the sheet be duplicated by some good process of reproduction. Inexpensive reproduction can be obtained at almost any "Letter Service" listed in the *Chicago Classified Telephone Directory*. Do not use carbon copies!

When using a letter, individualize each one to fit, as nearly as possible, the company or individual you are addressing. Use such expressions as "Mr. X suggested that I write," or "As you can see, I have had some experience with Y product (or Z technique)."

Plan to visit the office of each person to whom you address a letter and ask him, even if he has no job opening at the present time, for suggestions of other companies and individual names. Follow these up. These are usually more valuable leads than your first selections, because they have been screened by a man familiar with current activities in the field in which you are interested.

If you do not receive an answer to your letter within a week or two, call the office of the individual you addressed, and ask for an appointment to talk with him or with some person he may designate.

Letter to Prospective Employers

Do you employ people in statistical work?

Do you want a regularly available source of trained and experienced statisticians?

A roster of available statisticians and their educational and experience qualifications is maintained for the convenience of Chicago Area employers by the Placement Committee of the Chicago Chapter. The persons on our "available roster" are trained to apply statistical methods in such varied fields as economics, marketing, advertising, sociology, agriculture, labor research, insurance, and the physical sciences. They are research-minded individuals in their particular fields.

In many cases, the positions where these persons can be useful are not identified by the word "statistician," although statistical training is required. Some examples of work they might do for you are:

Market and Sales Analysis
Sampling and Survey Work
Graphic Presentation of Data
Analysis of Research Results
Analysis of Trends
Research Planning
Statistical Controls
Quality Control

For names and qualifications of available statisticians, please call me at FRanklin 2-7700 or write the American Statistical Association, Chicago Chapter, Room 2300, One North La Salle Street, Chicago 2, Illinois.

I am enclosing, for your information, a booklet which describes some of the functions and activities of our association.

Sincerely yours,
De Ver Sholes, Chairman
Placement Committee

SUMMER SESSIONS

STATISTICAL LABORATORY, UNIVERSITY OF CALIFORNIA, BERKELEY
1st Session June 18th through July 28th
2nd Session July 30th through September 8th

This year's summer program at the Statistical Laboratory of the University of California includes four of the usual undergraduate courses, two in each session, and two graduate courses. One of the latter is a regular course of lectures on rank correlation methods and on time series analysis. The other graduate course is a seminar on time series and related problems. Both graduate courses will be given during the first Summer Session by Professor Maurice G. Kendall of the London School of Economics and Political Science. Professor J. Neyman will be available for consultations on work leading to higher degrees. In addition to the above two persons, the faculty of the Summer Session will include Dr. Grace E. Bates (Mount Holyoke College), Dr. Colin R. Blyth (University of Illinois) and Dr. Gottfried E. Noether (New York University).

COLORADO

The college of engineering at the University of Colorado will conduct an intensive training course in Statistical Quality Control from June 19-29.

The course will include acceptance sampling and other industrial statistical methods used in industry.

Application or further information about the course can be obtained by writing John F. Wagner, College of Engineering, University of Colorado, Boulder, Colorado.

M. I. T.

A Special course in Modern Communications, including lectures and laboratory demonstrations on the theory of information and communication, will be a feature of the 1951 Summer Session at the Massachusetts Institute of Technology. The course will be given from June 18 to July 6, under the direction of Y. W. Lee, associate professor of electrical engineering.

The Research Laboratory of Electronics and the Acoustics Laboratory are joining the Department of Electrical Engineering in sponsoring the course, which will consist of an intensive treatment of topics selected from recent developments of theory, applying to both physical systems and human organizations. The course is designed for research engineers concerned with the problems of transmission, presentation and assimilation of information. It should be of special help to those interested in statistical methods and techniques for signal detection and those concerned with human organization as affected by the communication problem.

Preference in registration will be given to electrical and communication engineers and psychologists having a professional interest in the course. Further information on this and other summer courses at M. I. T. may be obtained from Professor Walter H. Gale at Room 3-107, Massachusetts Institute of Technology, Cambridge 39.

MICHIGAN

For the fourth consecutive year, the Survey Research Center of the University of Michigan will hold an annual summer institute in Survey Research Techniques. The regular session of the Institute will be held from July 23 to August 17, with an introductory session from June 25 to July 20, 1951.

The program of the regular session will include a lecture and symposium series and the offering of five courses in survey research techniques which can be elected for graduate credit. These courses are: Introduction to Survey Research, Methods of Sampling in Survey Research, Survey Research Methods, Advanced Methods in Survey Research, and Theory of Scaling. Two of these courses Introduction to Survey Research and Methods of Sampling in Survey Research, will also be given from June 25 to July 20 during the introductory session. This will permit students who are attending the full eight week summer session of the University (June 25 to August 17) to register for a sequence of introductory and advanced courses.

NORTH CAROLINA

The Institute of Statistics of the University of North Carolina is offering another summer session in applied and mathematical statistics, June 11 to July 19, 1951. This session is for research scholars in other sciences who want a practical working knowledge of statistical theory as well as for consultants, teachers and students in statistics. The teachers are G. W. Snedecor, W. J. Youden, R. L. Anderson, R. C. Bose, Gertrude M. Cox, A. L. Finkner, S. N. Roy, R. J. Monroe and H. Fairfield Smith. For details write Mrs. Sarah Carroll, Institute of Statistics, State College, Raleigh, N. C.

VIRGINIA POLYTECHNIC INSTITUTE

The dates announced in the February issue of *The American Statistician* for the VPI Summer Session, have been changed from August 1 to 19, to the new dates of August 8 to August 25, 1951.

Journal Exchange Wanted

Erich Preisser of the Institut fur Sozial und Staatswissenschaften at the University of Heidelberg, would like to offer a subscription to his Journal, *Jahrbucher fur Nationalokonomie und Statistik*, to an American statistician in exchange for a subscription to the Journal of the American Statistical Association. Anyone wishing to arrange for an exchange should get in touch with the American Statistical Association, 1108 Sixteenth Street Northwest, Washington 6, D. C.

The Distribution of World Income

by WILLIAM I. ABRAHAM
Statistical Office, United Nations

The keen and widespread interest in international comparisons of real income as a clue to how the rest of the world lives is matched only by the difficulty of making such comparisons with any degree of reliability. The number of serious studies in this field is small, and most statisticians will probably recall only the work of the International Labour Office, much of it now twenty years old, and of Colin Clark[1] in this connection. In view of the dearth of readily available information of this kind for recent years, except for small-scale inquiries, the United Nations Statistical Office has released estimates for a large number of countries showing national income and *per capita* income in dollars.[2] These figures are necessarily of a provisional nature, and were originally established for restricted use within the United Nations and certain of the specialized international agencies.

The Problems Involved

The problems inherent in comparing incomes for different countries are, broadly speaking, of two kinds. First there is the problem, or rather group of problems, connected with the compilation of national income estimates of sufficient conceptual comparability and quality to be used as a basis for meaningful comparisons. And secondly, there is the problem of converting these estimates expressed in national currencies into some common unit of measure. Generally speaking, it is mainly the latter problem which stands in the way of making satisfactory comparisons. The conversion procedure is beset by all the well known difficulties of making comparisons over time for a particular country (i.e., allowing for changes in the composition and quality of the national product, etc.), as well as by the even more intractible problems arising out of differences among countries in institutional arrangements, economic structure, tastes, habits, and so on.

While the problems of conversion are formidable enough where countries of similar characteristics are being compared, comparisons among widely divergent countries must by their very nature always be unsatisfactory. Those who may have occasion to use the results of the Statistical Office study will, consequently, have to bear in mind the limitations of data of this nature. The discussion of the methods and source materials employed in arriving at the final figures will serve to point up some of these limitations, and to give an appreciation of what the figures convey.

Of the 70 countries covered in the table, accounting for about 90 per cent of world population and an even higher percentage of world income, national income estimates for 1949 are available for fewer than 30 countries; and of these, perhaps only half are solidly grounded in statistical fact. For the balance it was necessary for the Statistical Office to prepare its own estimates for 1949 either by extrapolating earlier estimates, or by assuming a reasonable *per capita* income figure and multiplying by the population.

As might be expected, it is primarily the more highly industrialized countries that have the most reliable and up-to-date estimates. In the case of the underdeveloped countries, the basic economic statistics out of which estimates must be built are largely lacking. This is necessarily so since in a subsistence economy many activities are outside the monetary sphere and organized markets are of limited importance. Where estimates are available, there is always the danger that many activities or transactions have not been taken into account fully, and that the national income is consequently understated, perhaps even seriously.

Adjustments for Comparability

To the greatest extent possible, the published or estimated figures have been adjusted to conform to the standard definition of national income at factor cost adopted by the Statistical Office and recommended for use by the Statistical Commission and the Economic and Social Council.[3] This definition differs in only minor respects from the concept used by the U. S. Department of Commerce (as in the treatment of profits and losses of public enterprises) and by the United Kingdom in its National Income White Papers. Generally speaking, the adjustments which were made changed the totals only slightly. But in a few instances, as for Italy, Belgium, Poland and the Soviet Union, the adjustments were far from negligible. Thus, in the case of the official figures of the Italian national income, those government services rendered to business rather than to ultimate consumers are excluded, although the standard definition requires their inclusion. Since the figure for the value of such services is published, it is possible to make the necessary addition so as to include this important component. Likewise, in the case of Belgium, the treatment of taxes and certain transfer pay-

[1] Mr. Clark's latest calculations dealing with levels of real national product per man-hour may be found in *Review of Economic Progress*, Vol. 1, No. 4, April 1949, a publication of the Queensland Bureau of Industry, Brisbane. Comparisons are made in "international units" defined as the quantity of goods and services exchangeable for $1 in the United States in the base period 1925-34.

[2] Cf. *National and Per Capital Incomes of Seventy Countries, 1949*, Statistical Papers, Series E, No. 1, United Nations Statistical Office, New York, October 1950.

[3] For full information on this definition, cf. *National Income Statistics of Various Countries, 1938-1948*, United Nations, 1950, and *Measurement of National Income and the Construction of Social Accounts*, United Nations, Geneva, 1947.

ments is unusual, but the values involved are known and it is possible to make the required adjustments.

The estimates for Poland and the Soviet Union give rise to problems of a more refractory nature. In these countries, the concept of national income is essentially of a different character, since only new values created by the expenditure of labor in branches of *material* production are taken into account. (For the Soviet Union there are still other difficulties associated with the fact that the estimates available are not expressed in current prices but in 1926/27 prices.) In these cases the Statistical Office has had to make rough estimates, based largely on evidence gathered from older figures in better agreement with the customary definition of national income, of the large sectors of economic activity in government and the service industries generally in order to adjust the published figures for the purposes of the study.

The United Nations has attempted the challenging task of estimating the 1949 per capita national income of some 70 countries and expressing the results in dollars of 1949 purchasing power. Mr. Abraham's article deals with some of the issues involved in this work of estimation. National income data vary widely in accuracy and comprehensiveness from country to country. The underdeveloped nations often lack the census data essential to reliable computations. Soviet official national income estimates cannot be used without extensive, and to a certain extent arbitrary, readjustment.

The United Nations has prepared the only available estimates of the distribution of the world's 1949 current output of goods and services among countries and they should be of interest to all statisticians working in the economic field.

S. C. W.

Conversion to U. S. Dollars

Having arrived at a set of national income figures in national currencies conforming to a common definition, it was necessary to devise a procedure for expressing the figures in some particular currency unit to facilitate comparisons. Owing to the absence of detailed information on prices for a large number of goods and services for the various countries, conversion by the use of purchasing power parity rates could hardly be attempted, except on a small scale to check certain of the results obtained by other means. Of course, one possibility, and the most straightforward, is to rely simply on recent exchange rates, pre- or post-devaluation. But while this method of conversion would permit the various figures to be expressed readily enough in, say, dollars, the mechanical nature of the process would make it impossible in a great many cases to say unequivocally just what the final figures were presumed to mean.

It must be remembered that the postwar exchange rates are not, by and large, really free rates, but controlled and in many cases arbitrary rates supported only by more or less rigid exchange and import regulations. Certainly the exchange rates existing prior to the recent widespread devaluations sanctioned by the International Monetary Fund are not suitable for establishing dollar equivalents; the post-devaluation exchange rates are in many cases more in line with the purchasing power ratios of the various currencies, but even they would lead to incongruous results in a large number of instances if applied to all countries indiscriminately. It appears that it is to the prewar exchange rates that we must look if exchange rates must be used in the conversion process.

The method actually used in most cases by the Statistical Office consists in starting with the exchange rate for some prewar year, most often 1938, and correcting the rate to take account of changes in prices between that date and 1949 (usually as measured by the cost of living index) in the countries being compared. This means that we are able to rely on exchange rates for a period of greater stability and freedom from economic controls, and nevertheless arrive at dollar equivalents of 1949 purchasing power. But it also means that to the extent that the prewar year selected is unsuitable, or that reasonably good retail or other price indicators are not available, this attempt to circumvent the shortcomings of the postwar rates lets us down. Of course, where it was found that this method led to figures clearly out of line with other evidence, it was abandoned; and in such cases the post-devaluation rates were usually employed.

It hardly needs to be stressed here that the process of converting the figures for such a large and diverse group of countries calls for judgment and discrimination and that insistence on the rigid application of a particular method to all countries would often lead to meaningless results. It should also be clear that there is necessarily scope for disagreement even among competent persons engaged in making international comparisons of income, and that opinions would inevitably vary as to the appropriateness of using one method or another for converting some particular figure. Nevertheless, it is doubtful whether in a great many cases the discrepancies would be large enough to cause serious concern, particularly in view of the considerable margins of error associated with the unconverted estimates themselves.

It is possible to obtain some idea of the order of magnitude of such discrepancies by trying various procedures and rates of exchange, and some experimentation of this kind was done. In general, it was found that the use of a prewar exchange rate corrected for price changes in the intervening period led to figures near the center of the range of values obtained by different methods; and that extreme deviations, however obtained, could often be explained by some special circumstance, such as the acknowledged overvaluation or undervaluation of a currency.

The Resulting Per Capita Figures

The accompanying table presents some of the results of the United Nations study, and shows the level of *per capita* national income in seventy countries. While the figures speak for themselves, two important aspects might be noted here: (1) the extreme range, varying from under $50 per year to almost $1500; (2)

SEVENTY COUNTRIES CLASSIFIED BY SIZE OF PER CAPITA NATIONAL INCOME IN 1949

(U. S. DOLLAR)

Size of Per Capita Income	Nature of National Income Estimate Used[1]	Method of Conversion to Dollars[2]
Under $50		
Burma	b	a
China	b	a
Ecuador	b	b
Ethiopia	c	c
Haiti	c	c
Indonesia	b	a
Korea (South)	c	c
Liberia	c	c
Philippines	a	a
Saudi Arabia	c	c
Thailand	b	a
Yemen	c	c
$50-$100		
Afghanistan	c	c
Bolivia	b	a
Ceylon	b	b
Dominican Republic	b	a
El Salvador	b	a
Guatemala	b	a
Honduras	b	a
India	a	b
Iran	b	b
Iraq	c	c
Nicaragua	b	a
Pakistan	b	b
Paraguay	b	a
$100-$200		
Brazil	b	b
Chile	a	a
Colombia	b	a
Costa Rica	b	a
Egypt	b	a
Greece	a	a
Japan	b	b
Lebanon	c	c
Mexico	a	b
Panama	b	-
Peru	b	a
Southern Rhodesia	a	d
Syria	c	c
Turkey	b	a
Yugoslavia	b	a
$200-$300		
Austria	a	a
Cuba	b	b
Hungary	b	d
Italy	a	d
Portugal	c	c
Union of South Africa	a	d
$300-$400		
Argentina	b	a
Czechoslovakia	b	a
Finland	a	b
Germany (Western Zone)	a	b
Israel	a	a
Poland	a	a
U.S.S.R.	b	d
Uruguay	b	a
Venezuela	b	a
$400-$600		
Belgium	a	b
France	a	b
Iceland	b	d
Ireland	b	a
Luxembourg	a	a
Netherlands	a	a
Norway	a	a
$600-$900		
Australia	a	d
Canada	a	b
Denmark	a	a
New Zealand	a	d
Sweden	a	a
Switzerland	a	b
United Kingdom	a	d
Over $900		
United States	a	-

[1]) The symbols a, b, and c have been employed to denote the following:
a—Official or semi-official estimate
b—Estimate or extrapolation by the Statistical Office
c—Crude estimate by the Statistical Office based on an assumed per capita in dollars

[2]) The symbols a, b, c, and d have been employed to denote the following:
a—Pre-war exchange rate adjusted for price changes
b—Post-devaluation exchange rate (or average 1949 rate)
c—Assumed per capita figure in dollars (i.e., no conversion necessary)
d—Other (1949 pre-devalution exchange rate, etc.)

the markedly skewed nature of the distribution, with heavy concentration at the lower income levels.

These results are even more striking if we take into consideration the size of the population of the countries in question. The 25 lowest countries, that is, those with *per capita* incomes below $100, contain together well over *half* of the combined population! Only the 8 richest countries, with little more than one-tenth of the combined population, enjoyed *per capita* incomes in excess of $600 in 1949. The weighted arithmetic mean for all the countries is in the neighborhood of $250.

Fortunately, from the standpoint of economic welfare, the figures overstate the disparity between rich and poor. We must remember that in the predominately peasant countries many distributive services are of infinitely less importance than in industrial or even advanced agricultural countries. The egg on the peasant's table will not have been subjected to grading, packing, transportation, refrigeration, etc., but when consumed is certainly no less gratifying than if these costs had been incurred. Unless allowance is made for factors of this kind in interpreting the figures—and there are many such factors, including defense expenditures by the government—the figures will give an exaggerated notion of the difference in the standards of life between the very poor and the better off countries.

Interindustry Economics Research

by EZRA GLASER
Division of Statistical Standards,
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The input-output technique of economic analysis was originally developed by Professor Wassily Leontief of Harvard University. Its object is to provide the basis for estimating total requirements for goods and services, by separate industries, from some specified list of requirements for final demand. The most important particular contribution of the method is the explicit calculation of indirect demand. Hence it is a promising tool in the analysis of the requirements for intermediate goods such as steel forgings or electric energy consumed by industrial and commercial establishments.

Since 1941 the Bureau of Labor Statistics has been active in interindustry economics research, using the input-output technique developed by Leontief. The BLS prepared a detailed table of input-output relationships for 1939, using data from the 1939 Census of Manufactures, and made a variety of studies using this approach.

In 1948, at the behest of the Munitions Board of the Department of Defense, the Chairman of the National Security Resources Board invited the participation of Executive Office Agencies in a committee to be established within the Executive Office of the President to consider the desirability of systematizing and expediting the further development of interindustry (or input-output) economic research in the Federal Government. Members of the committee represented the NSRB, Council of Economic Advisers, and Bureau of the Budget. The committee issued a report, based on extensive study of the technique and comments received from a panel of experts and from other technicians, which stated, with qualifications, that "both at present, and in prospect, the interindustry relations study technique is the most efficient and comprehensive technique available for studying the total effects of any given program, civilian or military, on the economy and on the several industries in the economy." The committee recommended that the basic 1939 table (the most recent then extant) be brought up to 1947, and that other work be initiated for further testing of the technique. The preparation of a detailed 1947 table was begun by the Bureau of Labor Statistics under a grant from the National Security Resources Board.

The Department of Defense was also interested in uses of the technique for program planning purposes, as well as for its application to a possible emergency situation. In 1949 the Research and Development Board assigned to the Department of the Air Force responsibility for research in interindustry economics and for the extension of the technique to manpower mobilization problems. This assignment arose in part from existing Air Force activities in applying similar principles of analysis to program development and testing. The Munitions Board has recently assigned to the Department of the Air Force further responsibilities in this general area, primarily for the formulation of comparable requirements schedules for all three services.

The Department of the Air Force itself is developing some aspects of the project, such as the mathematical technique of program planning, and is arranging for the development of other aspects by contracts with Federal agencies and other institutions. Early in 1950 an arrangement was made by which the Bureau of the Budget recommends specific research contracts in interindustry economics and manpower, and monitors these studies. This arrangement was made with the two primary objectives of providing for the greatest possible utilization of existing Federal statistical series and of providing a central unit for coordination of the work being undertaken within the Government and by private foundations and universities. It will also facilitate the integration of interindustry projects with the statistical reporting programs of the mobilization agencies.

The outbreak of the Korean War caused the whole schedule to be speeded up. Test applications of the method with preliminary data will attempt to test the application of the technique to mobilization problems at a much earlier date than was originally scheduled. Actual operational use will be sought in all tests, but the analysis is not tied to any particular system of economic controls. The project is still properly classified as research because of the absence of experience in its application to actual mobilization situations, but the goal of practical use is set for the earliest practical date.

The central task is the preparation of a 1947 input-output table in much greater detail than was originally provided for. These data will allow the computation of flows of goods and services (in value units) from every industry to every other industry on the table, consistent with any sustained schedule of final-demand goods and services. This calculation assumes 1947 technology and product-mix within each industry. In order to overcome the obvious limitations of these data, further studies are being undertaken by the Bureau of Labor Statistics on Air Force contracts:

1. Modification of "input coefficients" (purchases from other industries to produce one unit of goods or services) for known changes in technology and product-mix since 1947; projecting trends of such changes into future years.

2. Development of production, price, and productivity indices for the same industries as are on the

basic table to allow for changes in prices and industrial structure since 1947, and employment and working hours to measure changes in the application of labor.

The projects described above would allow the testing of the industrial feasibility of a program which required the economic system to maintain specified levels of output for each industrial classification in the basic tables. Especially in mobilization programs, the significance of "dynamic" factors is prime. These are not accounted for in the simple formulations suggested above. Some industries have to increase output sharply; others will be curtailed. The kinds of products coming out of some of the most critical industries are subject to drastic change. New capacity has to be provided as requirements exceed existing ability to produce. New methods are adopted because of these shifts and to allow utilization of new groups in the labor force. Economic controls cause changes in the use of materials and widespread shifts in cost structures and material flows.

The most difficult problems of economic analysis and data gathering arise from these "dynamic" elements. The application of this kind of analysis to actual mobilization situations will depend on the provision of successively better data on these "structural" changes in the industrial system.

A number of studies of "dynamic" problems have been begun:

1. The Office of Business Economics is seeking the most useful measurement of capacity limitations in manufacturing industries (except the chemical industries). Data will also be obtained on the purchases from other industries which are implied by additions to capacity. Not only will new plants be considered, but conversion from other uses, modernization, and addition to existing facilities will be considered where appropriate. Both for changes in the rate of output and the use of additional capacity it will be necessary to estimate the time necessary to accumulate unprocessed inventories and goods-in-process as well as estimated time needed to obtain and install machinery and put it to work. (Training of labor is separately considered, and is discussed below.)

2. Harvard University has begun an intensive study of the various chemical industries, in the same framework as the Office of Business Economics studies of other manufacturing industries.

3. The Bureau of Mines has begun a study of energy needs of the economy in which the possible substitution of one fuel for another will receive special attention.

4. Plans are in preparation for capacity studies for electric power (on a regional basis) and freight transport (possibly on a regional basis in a later phase). The provision of data for specific critical commodities—the general analysis is on the basis of industries rather than products—will also be studied.

5. Changes in the character of the output of purely military industries are being studied at the Department of the Air Force. Capital equipment problems for a selected group of factories are being analyzed from the results of this study. The significance of production from the activation of stand-by plants is also a part of this project.

At present there are no plans for treating labor as an "industry" (more properly an "activity") in the formalized analysis. Rather labor requirements will be estimated from the computed levels of output of each of the industries after the input-output analysis has been completed. This is not the only alternative in the formulation of the analytical system, but the proposed method is probably capable of the earliest actual application to real problems.

Labor requirements will be estimated from levels of physical output by a special set of productivity factors being developed by the Productivity Division of the Bureau of Labor Statistics. These factors will match the industries in details of classification and aggregation.

Further refinements in the estimation of labor requirements will take account of occupational distribution of labor requirements and the analysis of manpower needs by labor market areas. These refinements may not be accomplished for some time, but several key studies are already under way:

1. An exploratory study of the requirements for workers with critical skills in the Machine tool and radio industries is now being made by the Bureau of Labor Statistics, Division of Manpower and Occupational Outlook. Studies of a similar character are being planned in other industries.

2. The patterns of and factors affecting labor mobility are being studied in a survey being conducted in 6 cities by the Bureau of the Census in collaboration with the Social Science Research Council. The Bureau of Labor Statistics is doing a similar study of the work-histories of tool and die makers.

The Dictionary of Occupational Titles describes some 18,000 separate occupations. Obviously there would be no point in estimating the need for each of these in a practical mobilization situation. One compromise is to study only a few occupations whose critical importance can be foreseen. This approach has value, but would leave out a good part of the allocation and training-program goals of a manpower mobilization agency. Hence another approach is being attempted, the full appraisal of which will not be possible for some time.

Each occupation can be characterized by a number of factors significant in the procurement and training of its members: physical and personality traits of the workers, kind of equipment used, materials worked on, industry in which usually found, degree of skill, etc. A sample of Dictionary of Occupational Titles is already being analyzed by the Bureau of Employment Security in an attempt to test a specific list of such factors. After a sufficient number of titles has been so characterized an attempt will be made to group them into "families." The object of these groupings will be to guide choice of trainees for skilled jobs and to reallocate workers as occupational requirements change. New skills should be most easily acquired by a worker whose occupation is in the same family as that of the training program.

It might be noted that the occupational distribution

and area analysis research is not an integral part of the interindustry research program at this stage. The studies could be applied to activity levels of industries however arrived at. In practice, however, the relationship is much closer, for the classification and aggregation patterns in the manpower research must match those of the industries in the input-output table.

Other projects are being undertaken by: the Social Science Research Council in cooperation with a number of universities—occupational mobility of labor; jointly by the Bureau of Employment Security and the Census—World War II manning tables; the Bureau of Mines—commodity applications of the technique; the Bureau of Labor Statistics—occupational composition problems; the Census—capital data from World War II data; and the Bureau of Labor Statistics—capacity studies from maximum employment estimates.

Most if not all the computation procedures have already been developed by the Department of the Air Force for its own internal programming studies. Various computation laboratories are available for the mathematical processing of the analyses, including those of the National Bureau of Standards. Very high speed computing equipment makes it practical to apply the input-output technique to quite detailed formulations of mobilization problems.

To date there has been little experience in designing test applications of the technique, without which we cannot appraise its practical usefulness. The prognosis is sufficiently favorable, however, to justify the time and staff resources being expended on the research program.

OLDEST EXPERIMENT STATION CELEBRATES 75TH ANNIVERSARY

by AMANDA QUACKENBUSH, Connecticut Agricultural Experiment Station New Haven, Connecticut

An event of interest to scientists everywhere took place this fall when the Connecticut Agricultural Experiment Station celebrated its 75th anniversary. Of far more than local significance, the date marked not only the beginning of a single institution but the birth of an idea. The idea was that science should be put to work for the farmer and its culmination was the establishment in Connecticut of the first agricultural experiment station in the Western Hemisphere. Once a start had been made, the idea spread rapidly and within 15 years after the founding of the first station, an experiment station had been established in each of the states.

As a matter of fact, the founding of the Connecticut Agricultural Experiment Station marked more than the beginnings of organized agricultural research in America. It was one of the first research institutes of any kind and for any purpose in the nation.

The pioneer research institute in Connecticut marked the occasion of its founding with two days of "stock-taking" of past accomplishments and a look forward along the paths science will travel in the future. Scientists from all over the nation and representing many branches of research gathered in New Haven this past September to hear addresses from world-renowned research workers and to bring greetings to the Connecticut Station on its birthday.

The speaking program listed such names as Detlev W. Bronk, president of the National Academy of Sciences and president of Johns Hopkins University; Dr. Selman A. Waksman, chairman of the Microbiology Department at the New Jersey Agricultural Experiment Station; Dr. Edmund W. Sinnott, Director of the Sheffield Scientific School and Dean of the Graduate School, Yale University; Dr. Alexander Wetmore, Secretary, Smithsonian Institution; Dr. George O. Curme, Jr., vice-president in charge of chemical research, Union Carbide and Carbon Corporation, and Arnold Nicholson, managing editor of *Country Gentleman*.

All of the speakers stressed the importance of science in present-day society. As Dr. Sinnott put it, "Among mankind's great tasks today, one of the most important is that of pushing forward the frontiers of scientific research, for on its results depends in large measure the progress of civilization."

Dr. Sinnott was moderator for a symposium on "The Research Institute in Modern Society" in which Drs. Waksman, Wetmore and Curme also participated. All four men emphasized the value of fundamental research. Dr. Sinnott said that we have been depending on European scientists for the "great new germinative ideas" which we apply to our problems. "We are strong in applications, in developments and engineering," he said, "but much less so in the fundamental contributions of theory on which these all are based." He advocated special training for work, which requires "less time spent in collecting data and more time spent in thinking about them."

As an example of the worth of fundamental research, Dr. Waksman traced the present interest of more than 1,000 investigators studying one group of soil fungi, the actinomycetes, to his own basic studies on the physiology of these fungi, started 35 years ago. This work led to his discovery of streptomycin, he said, and stimulated other workers to find other antibiotics, such as chloromycetin, aureomycin, terramycin and neomycin.

Dr. Curme pointed out that results of some basic studies may seem trivial and of no practical value when they are first published. However, he said, the records of science are permanent and cumulative, and most such basic work may be put to practical use.

Dr. Wetmore called for freedom of the scientist. He stated that "Science fettered retards human progress . . . The inquiring mind may reach a goal by being bound to prescribed formula or to preconceived notions, but it will never blaze a truly new trail or chart a truly new course."

In his address, "Science in a Democracy," Dr. Bronk reaffirmed the importance of freedom of thought and action as the only climate for successful scientific research. It is his belief, he stated, that one of the vital elements of our national strength is freedom for intellectual inquiry.

Dr. Bronk pointed to the totalitarian countries as examples of the results of restriction of intellectual freedom. There, he said, the progress and values of science are endangered by those who use science and scientists to achieve their selfish ends.

"Science," he said, "cannot flourish if the discoveries and thoughts of scientists are the secret knowledge of a few. Science cannot increase the understanding and improve the welfare of all men and women unless free access to knowledge is recognized as a fundamental human right."

In a democracy, he pointed out, science is everybody's business. "In these times, when scientists are considered necessary for the preservation of our social order and the defense of our nation, it is essential that their objectives and the course of scientific progress be widely understood. If our technological civilization becomes so complex that few can understand the thoughts and actions of others, few will be able to fulfill their democratic function of intelligent self-government . . ." The American public must recognize its status as "participating stockholders in the advancement of science" and scientists must "assume their responsibility as interpreters of science."

Going back to the issue of science in "a world half free to investigate, to speak and question, half slave to prejudice and dictation," Dr. Bronk concluded that the spirit of science could not long survive under such conditions. "The survival of undistorted science, uncontrolled except by experimental test and reason, depends upon victory for democratic freedoms in this great conflict of ideals," he said.

Mr. Nicholson, speaking on "Why An Agricultural Experiment Station?", said that part of the answer must be found beyond the borders of the United States. "Whether we like it or not," he stated, "we are today a world power, and the fortress for free men everywhere. Authorities who should know have reiterated that one of the golden keys to democracy is an ample food supply. We as a nation, cannot feed the world. But we can, and should, and already have begun, to export Professor Johnson's (founder of the Connecticut Station) great idea and our technical help to aid free men in other lands."

Within this country, he said, the health and vigor and stockpiles of the nation's farms in this year of "great danger" are an eloquent answer to the question "Why An Agricultural Experiment Station?"

"Alone of all industries," he said, "agriculture answered 'we are prepared' when the day of decision arrived this past summer. The agricultural experiment stations can take a great share of the credit for that preparedness."

Tracing the history of the agricultural experiment station movement since the establishment of the first station in Connecticut in 1875, Mr. Nicholson stated: "It would be hard to find, in history's pages, a development as perfectly matched to the times as the flowering of the agricultural experiment station idea in the last quarter of the 19th century. That was when we built the foundation for the industrial might that makes this nation great today; and our complex of iron and steel, steam power and transportation grew on the release of manpower from the land. Science and mechanical invention were the means for that release."

Besides the program of addresses, the Connecticut Station's two-day anniversary celebration included a four-hour Open House, open to all who wished to see its laboratories and greenhouses in action. Special demonstrations of scientific methods and equipment were featured.

The closing event was a banquet for official delegates and the Station staff, at which nine representatives of research institutions and organizations extended their greetings to the Connecticut Station. These included: Dr. Frank Yates, head of the Statistical Department, Rothamsted Experimental Station; Dr. P. V. Cardon, administrator, Agricultural Research Administration, U. S. Department of Agriculture; Dr. M. H. Campbell, director, Rhode Island Agricultural Experiment Station, representing the Section of Experiment Stations of the Association of Land-Grant Colleges and Universities; Dr. Joe Webb Peoples, Professor of Geology, Wesleyan University; Dr. Albert N. Jorgensen, President, University of Connecticut; Dr. Sinnott; Dr. Norman A. Shepard, Chemical Director, American Cynamid Company, representing the Industrial Research Institute, Inc.; Dr. George A. Baitsell, Profesor of Biology, Yale University, representing the American Association for the Advancement of Science; Dr. Bronk, representing the National Academy of Sciences, and Dr. Evelyn Hutchinson, Professor of Zoology, Yale University, representing the American Academy of Arts and Sciences.

A permanent reminder of the anniversary celebration is a bronze tablet mounted in a granite boulder which now stands at the main entrance to the Connecticut Station grounds, marking the site of the first American experiment station. It was formally presented to the Station during the anniversary ceremonies by Raymond A. Loring, chairman of the Connecticut Development Commission, on behalf of a group of Connecticut citizens who raised funds for its placement.

In making the presentation, Mr. Loring said, "It is obvious that the work of this first experiment station has been successful, and that the people of the State want to show appreciation of the work. The native Connecticut boulder will serve as a perpetual reminder to those who visit these beautiful grounds that this is the first experiment station in America."

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One Answer to the "No Change" Problem

by ALAN S. DONNAHOE

Sooner or later everyone has the problem of charting the three categories: "increase—decrease—no-change," or some variation thereof.

It is an awkward presentation problem because we associate each category with a definite direction. Increase is up, decrease is down, and no-change is neither. To plot no-change in the same direction as either increase or decrease violates our sense of conceptual propriety.

Typically, of course, these data are presented in the form of component bars (Chart A). This is a workable but not an altogether satisfactory solution. Because the chart form is contrary to directional concept, it leaves us with a vague feeling of impropriety.

The obvious way to get some sense of fitness into the picture is to extend the negative segments from one side; the positive segments from the other side of a common chart line: but this leaves us with no logical place to put the "no-change" segments. We may sometimes get around this difficulty by considering no-change to have a positive or a negative value. For example, if we may logically consider no-change to be good, it may be plotted in the same direction as either increase or decrease, depending upon which of these conditions we judge to be good. But this involves a rather weighty editorial decision with which some readers may violently disagree. On this ground alone, if no other, this method will be rejected in many cases.

A more elegant solution to the problem is shown in Chart B. Like most neat solutions, this one is so obvious that it has generally been overlooked: at least this writer had never seen it before.

This chart form actually is a cross-section of a three-directional figure in which the horizontal bar appears as the edge of a plane. With the form, we are able to give explicit recognition to the kinship between graphical and conceptual direction: increase is up, decrease is down, no-change is horizontal.

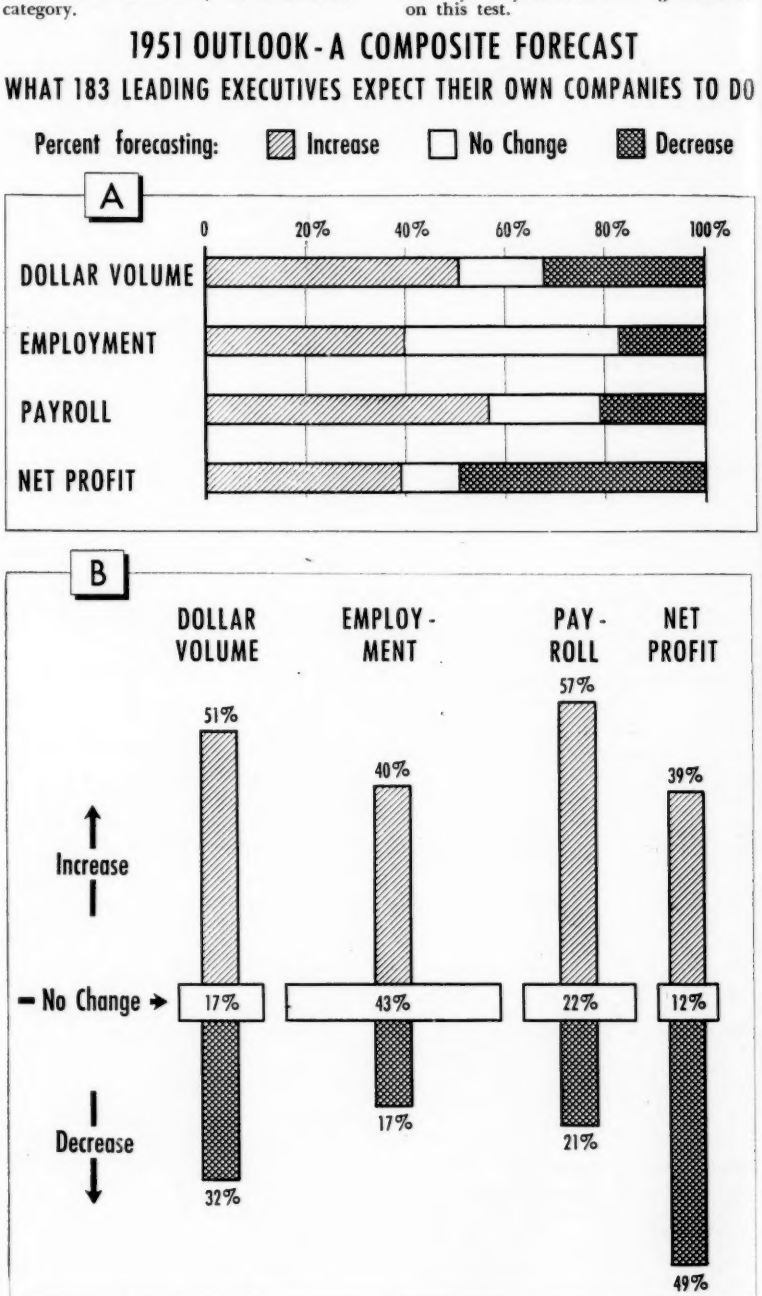
This is an important advantage, but, as always, there are some drawbacks involved. First of all, this chart presents a labeling problem. The form of construction makes it difficult to apply the principle that all labels and captions should be as close as possible to the things identified.

Further, this type of chart is difficult or impossible to fit into a narrow left-to-right space, especially when one or two of the no-change segments are long. And for the same reason, the inclusion of more than a half a dozen or so items is seldom feasible.

Neither does the chart lend itself very well to a time series. The chart appears awkward unless it is drawn with equal spacing between the horizontal bars; which means, of course, that the spacing along the horizontal axis must be unequal: and this is not appropriate for a uniform time interval.

Beyond all this, the chart may be ruled out in some instances because of a subtle psychological disadvantage. To some readers, the increase and decrease bars may suggest *degree of change* rather than *number of items* in each category.

The final test for every chart, however, is the impression upon the reader; and if problems of space and labeling can be solved, this three-directional chart—because of its conceptual consistency—may achieve the highest score on this test.



Statistical Training for Engineers

by PAUL S. OLMSTEAD

A young engineer approached me the other day to inquire where he could obtain a course in quality control thinking. He stated that he did not want mathematical statistics which he felt he could read and grasp by independent study. However, he did want to find out about the reasoning that has made quality control statistics important in engineering today. He wanted to find out how statistical quality control differed from the engineering approach to problems as it has been expounded to him as an undergraduate and as he had found it in his engineering work. He also wanted to know in what ways he could consider them to be alike.

This case study may or may not be typical but it does open the way to discussion of statistical training for engineers from the viewpoint of the engineer. Before we can answer his questions, we must know something about what the engineer does. Many of us think that *mass production* is the primary field of the engineer. Few, however, have gone behind this accepted generality to see what makes mass production possible. We have limited our attention to the process of making things as nearly as possible alike. This has led to the statistics of acceptance sampling, the detection and identification of assignable causes, and the correction or adjustment of specifications and manufacturing processes. In so doing, acceptance sampling tables and control charts have been the major statistical elements used.

Suppose we consider mass production more in detail. If we are to have mass production, we must have a design, usually embodied in a detailed specification. The design itself is a product of research, development, and invention. These, in turn, might never have occurred except for the observation by someone that the product would satisfy the wants of a substantial proportion of the potential consumers. It is a natural consequence, then, that the engineer must show that his product after manufacture does in fact satisfy these wants in an adequate, dependable, and economic manner. If the product does not measure up to this standard, it is necessary to do more consumer research, more research and development, more design and specification, more producing, more inspecting, and more checking to see whether the desired goal has been reached. For the manufacturing engineer, this is a continuing process. Competing products offer more of one quality characteristic and less of another in their efforts to reduce costs and to maximize consumer acceptance.

The engineer who has this problem was trained in applied physics and chemistry where it is often customary to assume that with proper precautions it is possible to obtain almost exact agreement with physical laws. The "almost" is included with the idea that with sufficient measurements the errors will always average out. It is somewhat of a shock to the average engineer to find that manufacturing processes fail to live up to the almost exact agreement with the specification that he anticipates. Historically, the setting of maximum and minimum specification limits for individual units was intended to move the place where such agreement was necessary to an unimportant point. As time went on, the limits became more important and even the engineer tended to forget that the major information that he had about the design related to what was associated with a nominal value often located halfway between the limits. Since the engineer's problem at the time related to trouble at the limits, it is natural that he first became interested in acceptance sampling, particularly sampling related to attributes. But when he found that low per cent defective meant large samples for given risks, interest in other ways to limit the risk with smaller samples became apparent. This was particularly true where destructive tests were required. The control chart for variables allowed the engineer to think again in terms of the nominal value as well as to reduce the size of sample required. It also gave a continuing picture of product quality relative to a desired nominal that he could place before the worker in his plant. By encouraging the worker to aim at the nominal rather than a limit, the engineer found that the limits became less important. The worker, too, found greater satisfaction in the better product. The result has been to improve employee relationships as well as to improve the product.

Out-of-limit performance on the control chart often resulted in finding assignable causes that were worth correcting. With this type of assurance, the engineer was prepared to undertake steps in the direction of using other statistical procedures that might help him in solving research and development problems. Here, things become more complex. The engineer needs to know about statistical design of experiments. He has the advantage over the agricultural experimenter in that, usually, he need not wait a year to make a new experiment if something unforeseen occurs in his first design. In addition, he records as pertinent other information anything that occurs that might serve to explain the out-of-control values that experience has led him to expect. He designs his experiment so that it has a repetitive element that is small relative both to the out-of-control type of trouble and the main effects that he wishes to determine. Information of this type is more often than not available prior to the experiment. This is because in engineering work each experiment is an element in a succession of experiments. Each experiment is different from the one before and the engineer wants to know how much. However, he would not be willing to apply any of the customary statistical measures

until he had examined his data for control based on the repetitive feature of his experimental design.

Troubles that he may expect are related to his past experience and may be classified to some extent by the following which were discussed in my talk before the Association at Cleveland in December 1948:

1. A gross error or blunder—usually one or two observations that differ markedly from the group,

2. A shift in level—usually associated with a change in some condition,

3. A shift in variability—sometimes associated with the observer,

4. A trend—often associated with aging or time,

5. A cycle—sometimes related to time but caused by a factor that changes with time such as humidity.

As indicated in the descriptive terms following each of these types of trouble, the engineer usually knows what to suspect as a possible assignable cause once he knows what type of trouble is present. Statistical measures exist for each of these types of trouble. In fact, there are at least three or four simple measures for each. The engineer should be familiar with each. However, in any particular case, there is apt to be disagreement between the measures. The engineer should know when to expect agreement and when disagreement so that he may evaluate the usefulness of the tests in helping him to catch his troubles.

In presenting statistical tests of this kind to engineers, it must be kept in mind that the only efficiency that is meaningful to him is that associated with catching trouble. His is the problem of detecting lack of control and tests that are efficient under the assumption of control often do not satisfy his desired requirement of efficiency for detecting trouble when trouble is present.

Statistics at Chicago

by W. ALLEN WALLIS
University of Chicago

The University of Chicago in 1949 established a Committee on Statistics which is in all respects equivalent to a department, having its own faculty, budget, and curriculum. Its purposes are (1) research in the theory and applications of statistics; (2) instruction in statistics at levels extending from introductory courses contributing to general education through the provision of facilities for postdoctoral research; (3) consultation on the statistical aspects of research throughout the University; and (4) provision of facilities for research, study, and application of statistics, which includes machines and laboratory equipment, essential library facilities, seminars, and lectures by distinguished visiting statisticians.

The faculty of the Committee includes R. R. Bahadur, Milton Friedman, Leo A. Goodman, John Gurland, Tjalling C. Koopmans, William H. Kruskal, Harry V. Roberts, Murray Rosenblatt, Leonard J. Savage, Charles M. Stein, and W. Allen Wallis (chairman). Among statisticians in other areas of the University under whom students may work are Walter Bartky (Physical Sciences), Donald W. Fiske (Psychology), Philip M. Hauser (Sociology), Paul R. Halmos (Mathematics), Karl J. Holzinger (Education), H. Gregg Lewis (Economics), Jacob Marschak (Cowles Commission for Research in Econometrics), William Stephenson (Psychology), Louis L. Thurstone (Psychology), Josephine Williams (National Opinion Research Center), and Sewall Wright (Zoology).

The following courses are offered by the Committee, each representing one-third of a full-time program for one quarter, unless longer duration is indicated:

Elementary Courses: No elementary courses are given by the Committee itself, but it cooperates closely in the elementary statistics courses in Business, Economics, Social Science, Sociology, and Psychology; it has, in fact, been instrumental in merging these elementary courses and preparing a syllabus in elementary statistics.

Intermediate Courses: Introduction to Statistics; Statistical Inference (3 quarters); Introduction to Mathematical Probability; Introduction to Mathematical Statistics (2 quarters); Sample Surveys.

Advanced Courses: Analysis of Variance and Regression; Estimation and Tests of Hypotheses; Statistical Theory of Decision-making; Theory of Minimum Risk; Sequential Analysis; Non-parametric Inference; Multivariate Analysis; Design of Experiments; Time Series; Statistical Problems of Model Construction; Limit Theorems of Probability theory; Markov Processes; Mathematical Techniques of Statistics.

Research Courses: Statistics Seminar; Master's Thesis; Doctor's Thesis; Consultation.

In addition, a number of courses of interest to Statistics students are offered in various departments other than the Committee on Statistics, e.g., Factor Theory (Education and Psychology), Econometrics (Economics), Quality Control (Business), Index Numbers (Business), Biometrics (Zoology), etc.

Three kinds of degree may be obtained at Chicago in Statistics:

(1) *The M.A. or Ph.D. in a subsantive field, with concentration in Statistics* is not administered by the

Committee, but it cooperates fully with the substantive departments in these degree programs, and several of its courses, especially at the intermediate level, serve these students.

(2) *The M.A. in Statistics* is awarded on the basis of (i) a thesis, (ii) written examinations, (iii) work in a minor field. The usual program for the M.A. covers three years beyond the sophomore year of the standard four-year college. For students with a standard four-year bachelor's degree it requires one or two years, depending upon their undergraduate training.

The master's thesis ordinarily represents a reasonably extensive application of statistics, though occasionally theoretical topics are allowed. It must be submitted by the end of the quarter *preceding* that in which the degree is to be awarded, since extensive revision based on faculty criticism is a normal part of its preparation.

Typical course-work in preparation for the master's examinations includes four quarters of mathematical analysis at the level of Courant's *Differential and Integral Calculus,* three quarters of the algebra at the level of Birkhoff and MacLane's *Survey of Modern Algebra* and Halmos' *Finite Dimensional Vector Spaces,* one other mathematics course, three quarters of general statistical analysis at the level of Fisher's *Statistical Methods for Research Workers* and the Statistical Research Group's *Techniques of Statistical Analysis,* a quarter of mathematical probability at the level of Feller's *Probability Theory and Its Applications,* two quarters of general mathematical statistics at the level of Cramer's *Mathematical Methods of Statistics* and Wilks' *Mathematical Statistics,* one quarter of the general seminar, and two additional quarters of advanced statistics. Not the courses themselves but the written examinations are the basis for awarding the degree.

The requirement of a minor field can be met by doing good work in an integrated group of five courses in a field to which statistics can be applied, or by some equivalent.

(3) *The Ph.D. in Statistics* is awarded on the basis of (i) preliminary written examinations, equivalent to the master's written examinations; (ii) work in a minor field such as is required for the M.A.; (iii) participation in the statistical consultation activities of the Committee; (iv) a reading knowledge of two approved foreign languages; (v) a dissertation of the scope and originality appropriate at the doctoral level; (vi) a lecture on the content of the dissertation, delivered at an open seminar; (vii) a final oral examination. Work at the doctoral level ordinarily includes about eight courses in Statistics and three in Mathematics beyond those in the normal master's program. The doctor's program ordinarily requires two to three years beyond the master's degree.

Students interested in studying statistics at Chicago may write to the Committee on Statistics, 113 Eckhart Hall, University of Chicago, Chicago 37.

COMMITTEE REPORTS—continued

Experience shows that the best "selling points" for institutional memberships are: the new section on Economic and Business Statistics; the opportunity provided at annual meetings for open objective discussion of many problems of vital interest to business, particularly when statistics are a focal point of controversy; the special work of ASA in helping maintain the highest professional standards in government and allied statistical series and analyses; inclusion of two individual ASA memberships with the institutional membership; and the established, high professional standing of the ASA, dating back to 1939.

The Committee comprises:

Walt S. Brush, Consolidated Edison Co., New York;
Andrew T. Court, General Motors Corporation, Detroit;
Lester S. Kellogg, Deere and Company, Moline;
Benedict Saurino, Sun Oil Company, Philadelphia;
Mortimer Spiegelman, Metropolitan Life Insurance Co., New York.

A. T. Court and Ben Saurino have been particularly helpful in obtaining several new members in the automobile and petroleum industries, respectively.

Respectfully submitted,
WALTER E. HOADLEY, JR., *Chairman.*

1950 Report of the Joint Committee on Occupational Classification

This Committee has held several meetings devoted to a consideration of the industry code to be used in the 1950 Census of Population and to the plans for publishing labor force statistics by industry. Most of the changes suggested by the Committee were editorial in nature but a major recommendation to distribute Government employment in functional terms was supported. This recommendation implements comparability with the UN International Standard Industrial Classification but is at variance with the present structural framework of the U. S. Standard Industrial Classification for Government employment. In all other respects, the content of major industry groups (other than Government), as between the Census of Population code and the U. S. Standard Industrial Classification, has been maintained on a comparable basis to the maximum extent possible. Other sessions of the Committee were devoted to a consideration of technical problems in international occupational classifications. On the basis of the Committee's discussions, technical documents were developed for use by U. S. delegates to the Bogota Conference of the Census of the Americas and to the

NEWS about MEMBERS

Ralph H. Bacon is with the General Precision Laboratory of Pleasantville, New York, where he is working on problems involving the design of experiments, the analysis and reduction of empirical data, as well as other theoretical problems concerning the development and test of automatic computers.

Robert T. Bower, formerly associated with the Bureau of Applied Social Research at Columbia University, has been appointed director of the Bureau of Social Science Research of The American University in Washington, D. C.

Lyle D. Calvin has accepted the position of Biometrician in the Biological Research Division of G. D. Searle & Co., Chicago, Illinois.

Allen L. Edwards is on leave of absence from the University of Washington. He received a post-doctoral Research Training Fellowship from the Social Science Research Council for 1950-1951 and is working at the University of Chicago on problems of measurement with respect to attitudes and personality.

Robert R. Fuldauer formerly of the Charis Corporation in Allentown, Pennsylvania, is now with the National Production Authority as a commodity industry analyst.

Seymour Friedland is now attached to the Economic Statistics Section of the Population and Housing Division in the Bureau of the Census. He is a specialist in labor force and income questions.

Milton Gilbert, Chief of the National Income Division, Department of Commerce, has accepted an appointment as Director of Statistics at the Organisation for European Economic Cooperation, Paris.

Stanley L. Isaacson, who recently received his Ph.D. in mathematical statistics from Columbia University, is now working as assistant professor of statistics in the Statistical Laboratory at Iowa State College. The position involves graduate teaching, consulting and research.

Elmer L. Lander is now employed as a statistician in the General Accounting Department of Cadillac Motors Division, General Motor Company in Cleveland.

George S. Little is now employed by the Economic Statistics Section of the Southwestern Bell Telephone Company, working on public attitude surveys and sampling surveys.

Joseph Mandelson has transferred from his former position as Chief, Quality Assurance Branch, Inspection Division, Office of the Chief Chemical Officer at Army Chemical Center, Maryland to Dugway Proving Ground, Tooele, Utah as Chief, Plans and Evaluation Office, Technical Operations.

Forbes McKay has been made Vice-president and Advertising Sales Director of the Farm and Ranch Publishing Company with headquarters in Nashville, Tennessee.

John Edward McManus has accepted a position as social worker with the Massachusetts Department of Public Welfare.

Jesse T. Nicholas is on military leave from the Bureau of the Census and is serving as Procurement Review Officer, G-4 Section, at the Headquarters of the Second Army at Fort George G. Meade, Maryland.

William H. Peckham is now staff statistician with the American Brass Company at Waterbury, Connecticut.

Jacob Perlman, connected with the Social Security Administration for the past ten years, has been appointed a member of a Technical Mission of the United Nations to the Republic of Colombia. He will serve for twelve months at Bogota, working on business indices, including prices, industrial production, etc.

Don C. Price is now working for the Institute for Cooperative Research at the Johns Hopkins University.

Wallace J. Smith, formerly with the Minnesota Division of Employment and Security is now a market analyst with the Standard Oil Company (Indiana) in Chicago.

John Thompson is now working as a trainee in the Quality Control Department of the R. C. A. Victor Division, Engineering Products Division.

P. K. Whelpton has taken a two year leave from the Scripps Foundation for Research in Population Problems and is now working as Director of the Population Division, Department of Social Affairs, of the United Nations.

Roswell A. Whitman has accepted a position as Economic Counselor at the American Embassy in Oslo, Norway.

COMMITTEE REPORTS—continued

U. N. Population and Statistical Commissions and official technical inquiries from international agencies to our Government were answered.

A considerable progress in the clarification of concepts (and language) for labor force analysis and improvement in the comparability of labor force statistics between nations can be reported. A substantial contribution to such progress has been made by this Committee in the past two years.

Heretofore, the Committee's activities have been jointly sponsored by the American Statistical Association and the Division of Statistical Standards of the Bureau of the Budget. By agreement between the two agencies, the activities for 1951 will continue under the sponsorship of the Division of Statistical Standards.

Members of the Joint Committee for 1950 were: Gladys L. Palmer (Chairman), Division of Statistical Standards; Carl A. Heinz (Secretary), Bureau of Employment Security; Henry P. Avery, Personnel Policy Board, Office of Secretary of Defense; Meredith B. Givens, N. Y. State Department of Labor; Reuben Horchow, Department of the Army; David Kaplan, Bureau of the Census; Harry Ober, Bureau of Labor Statistics; George Price, Department of the Navy; Lazare Teper, International Ladies' Garment Workers' Union; Emmett H. Welch, National Security Resources Board.

GLADYS L. PALMER, *Chairman.*